





## SYMPATHETIC PAINS: THEIR NATURE AND DIAGNOSTIC VALUE.<sup>1</sup>

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I VENTURE to call your attention this evening to a series of phenomena of which it may be said that all are interesting, many of great importance in diagnosis, and some curious and even fantastic in their characters. Many that were at one time complete puzzles to the physician have in recent years been elucidated by clinical investigations and speculations, but a considerable number, particularly of the less common varieties, still remain unexplained.

For the understanding of these sympathetic pains, two principles must be borne in mind. The first of these is a familiar one—viz., that sensations induced by the irritation of a sensory nerve in any part of its course are referred to the peripheral distribution of that nerve (a law first pointed out by Descartes). For example, when a blow is received on the ulnar nerve behind the internal condyle, pain is felt in the territory to which this nerve is distributed—in the inner part of the hand and inner fingers. It is true that pain is also felt at the seat of injury, but that is because the *nervi nervorum* distributed to the sheath of the nerve trunk are irritated. This is perfectly consistent with the principle just enunciated, but the important point for us in the meantime is that painful stimulation of the long nerve fibres is referred by the sufferer to the distal distribution or origin of these fibres, no matter in what part of their course the stimulation be applied. Thus, disease of the posterior nerve roots often causes pains in the legs, and a frequent mistake is to diagnose such pains as

<sup>1</sup> Slightly altered from a paper read to the Southern Medical Society of Glasgow on 5th May, 1898.

rheumatic when they are really a symptom of locomotor ataxy; an examination of the knee-jerks will almost always remove doubt. Sometimes a patient comes complaining of pain in the front of the abdomen, without any local cause that can be made out on examination. The doctor, however, recollects that some of the intercostal nerves are distributed to the anterior abdominal wall, and that in the early part of their course they are closely related to the pleura, and on further investigation he may find in the physical signs of a pleurisy a sufficient explanation of the symptom actually complained of.

The second principle is that when energy travelling along a sensory nerve tract reaches its termination in the grey matter of the spinal cord, it tends to diffuse itself in that grey matter, and so to influence the proximal terminations of neighbouring sensory nerve tracts. The result is that, in accordance with the first principle, the person refers the sensory impression to the peripheral distribution, or rather origin, of these neighbouring tracts. For instance, pain due to dental caries may be felt not only in the diseased tooth, but all over the side of the head. The impulses which travel by the dental nerve set up discharges not only in the centre with which that nerve is related, but also in neighbouring centres. This is spoken of as the "radiation" of pain. Sympathetic or referred pains or neuralgiæ, though akin to radiating pains, can generally be distinguished from the latter. They are pains experienced at a distance from their cause, or pains which are not connected with their cause by any obvious direct path of conduction. They are sometimes called "reflex neuralgiæ," but they must be clearly distinguished from reflex actions. A reflex neuralgia is a sensory phenomenon, while reflex action is motor, though both are called forth by sensory stimuli.

As John Hunter remarked,<sup>1</sup> these sympathies are often not reciprocal. For instance, there is frequently pain in the shoulder when the liver is diseased, but the liver never sympathises with a painful shoulder. And disease of the bladder often gives rise to pain in the glans penis, but the bladder does not sympathise with a diseased glans. Sometimes, however, the sympathy is reciprocal. Thus, disorder of the stomach often occurs in cases of disease of the head, while pain in the head is one of the most familiar symptoms of a disordered stomach.

Now, it is at once obvious to us as students of physiological science, that the word "sympathy" is too vague and meta-

<sup>1</sup> *Works of John Hunter*, edited by Palmer, 1835, vol. i, p. 321.

physical to be accepted as a final explanation of the phenomena which we are considering. As John Hilton, the author of *Rest and Pain*, long ago urged,<sup>1</sup> we ought to consider such pains as due to some nervous communication between the painful part and the actual seat of disease.

The best way to approach the study of sympathetic pains is, I think, first of all to arrange those we can understand in a series of groups and deal with them, leaving those that refuse to be classed in accordance with known physiological principles for later consideration.<sup>2</sup>

In the first place, then, there are comparatively simple cases, where (somatic) pain is induced in a certain locality by disease elsewhere on the same side of the body. One of the best known illustrations of this group is the pain at the knee in hip-joint disease. Both joints are supplied by the obturator nerve, which is derived from the second, third, and fourth lumbar nerves. We must assume, in accordance with our second principle, that the sensory impulses generated by the morbid process in the hip-joint reach the grey matter of the lumbar cord and diffuse themselves so that they reach the termination in the cord of the nerve-fibres from the knee-joint. Thereupon, in accordance with our first principle, pain will be referred by the patient to the knee-joint. So, too, earache and toothache often go together, and malignant disease of the anterior third of the tongue frequently causes pain in the auditory canal, because the teeth, the anterior part of the tongue, and the auditory canal are all supplied by the fifth nerve.

It is a curious and interesting fact that the sympathetic pain may be more severe than the pain at the seat of disease, nay, that the seat of disease may be actually free from pain. This sometimes happens in dental caries, and, by way of illustration, I shall mention an actual case. A young man had the second molar of his left lower jaw to a large extent destroyed by caries. Thereafter he began to suffer severe intermittent neuralgia in the first molar of the upper jaw on the same side. This tooth was free from any sign of disease. The carious tooth in the lower jaw was practically, if not completely, free from pain. After a time, the carious tooth

<sup>1</sup> *Lancet*, 1860, vol. ii, p. 256.

<sup>2</sup> The sympathetic pains referred to in this paper are not selected with a view to a complete list, but on account of their frequent occurrence, diagnostic importance, illustrative value, &c. For other pains of this kind, with their anatomical substrata, reference may be made to the last edition of *Quain's Anatomy*, and to the writings of Head, Thorburn, Ross, and other recent investigators.



became tender on pressure from inflammation of its root, and was extracted, with the immediate result that the upper molar ceased to give trouble. In this instance, pain induced by a lesion involving the third division of the fifth nerve was felt only in a limited portion of the area supplied by the second division.

With regard to cases such as this, the late Dr. W. B. Carpenter made an important remark. "Certain it is," he says, "that after a long continuance of some of these reflex sensations, the organs to which they are referred often themselves become diseased, although previously quite healthy; this perversion of their normal action being not improbably due to that habitual direction of the attention to the part which is prompted by the habitual sensation."<sup>1</sup> This is borne out by the sequel of the case I have narrated. The upper tooth, which had been painful but apparently healthy when the lower tooth was extracted, became before very long the seat of caries, though without much pain. Eleven years later, I believe, the remaining teeth were all still healthy.<sup>2</sup>

In the second group of cases, a lesion on one side of the body gives rise to pain or other sensory disturbance in the corresponding part on the other side. Thus, a young man who had sustained a dislocation of his right shoulder-joint was still suffering, months afterwards, from numbness and a feeling of pins and needles in his right thumb. This condition was aggravated by rubbing, and a similar feeling was sometimes induced by rubbing or striking, though it did not occur spontaneously, about the root of the left thumb. Weir Mitchell tells of a man who, having a whitlow in his right thumb, had, until it was relieved, severe pain in the left thumb as well as in the affected part.<sup>3</sup> In the American civil war, a man was wounded by a shell in the outer part of the left thigh, and he felt pain immediately in the same area of both thighs; indeed, he thought that he was shot through both thighs.<sup>4</sup> The pain may be complained of only in the side opposite to the seat of the disease. Some years

<sup>1</sup> *Mental Philosophy*, sixth edition, p. 151.

<sup>2</sup> Another possible explanation is that the part which is the seat of referred pain is already in an early stage of disease, and is therefore in a morbidly irritable and sensitive condition. In the same way, physicians regard with suspicion the occurrence of vicarious menstruation from the respiratory system, on account of the reason there is to fear that the pulmonary hæmorrhage comes from a part whose vitality is already impaired.

<sup>3</sup> *Clinical Lessons on Nervous Diseases*, 1897, p. 233.

<sup>4</sup> S. Weir Mitchell, *op. cit.*, p. 234.

ago I examined a man who complained of pain in one side of the chest, and found that his ailment was pneumonia of the opposite side. Cases have been recorded of pain at the right lower costal margin due to pleurisy with effusion on the left side.<sup>1</sup>

The third group is large and of vast importance. It includes the superficial pains which are often caused by disease of the viscera. One of the simplest of these referred pains, so far as its anatomical basis is concerned, is that which is experienced at the tip of the shoulder in many cases of pericarditis, pleurisy, peritonitis, hepatic abscess, and hepatic colic. Now the pericardium, pleura, and peritoneum all get branches from the phrenic nerve, which arises principally from the fourth cervical nerve, though partly also from either the third or the fifth. As the integument over the shoulder-tip is supplied by the external supra-clavicular nerve, which is derived from the third and fourth cervical nerves, we can understand how irritation of the phrenic may lead to pain in this situation.<sup>2</sup> I have found this right shoulder-tip pain of great value in the early diagnosis of deep-seated hepatic abscess.

For the elucidation of most of the referred pains of this third group we must invoke the aid of the sympathetic system of nerves. It will be remembered that not only the vertebral column but also the spinal nerve-roots as they leave it present in a high degree a segmental character. The nerve-roots enable us to imagine a similar segmentation in the cord, and a typical spinal segment gives off fibres in the following way. First, the anterior or motor and posterior or sensory roots join to form a mixed nerve. Then this divides into two parts, the anterior and posterior primary divisions, both of which are mixed. Previous to the division the mixed trunk gives off a small recurrent branch to the spinal canal, and after the division the anterior primary division gives off the white ramus communicans or visceral branch to a neighbouring ganglion on the sympathetic cord. The point to be borne in mind is that both afferent and efferent fibres pass between the spinal nerve and spinal cord on the one hand, and the sympathetic on the other.

<sup>1</sup> Jago, *British and Foreign Medico-Chirurgical Review*, 1861, vol. xxvii, pp. 496, 497.

<sup>2</sup> Until 1853 anatomists looked upon the phrenic nerve as simply motor, but in that year Luschka, in his monograph on the phrenic nerve of man, endeavoured to prove that it has a twofold function like the ordinary spinal nerve. Luschka suggested, in this work, the anatomical explanation given above of the shoulder-pains of pleuritis and pericarditis. (See review of Luschka's monograph in *British and Foreign Medico-Chirurgical Review*, 1853, vol. xii, p. 343.)

The particular level of the cord from which the sensory fibres for the several viscera arise has been ascertained in more than one way. Thus, on the one hand, Edgeworth has traced fibres anatomically from the posterior roots of the spinal nerves to the sympathetic, and thence to the viscera. And on the other hand, Head, extending the clinical and pathological observations and speculations of Hilton, Ross, and Thorburn, has studied the areas of hyperæsthesia which are to be found on the skin in cases of visceral disease. These two very different methods lead to almost identical results. Thus, the sensory supply of the heart is from the three upper dorsal nerves, and so we have an explanation of the pain in the arm in angina pectoris, for the greater part of the first dorsal and the intercosto-humeral division of the second take part in the nerve supply of the upper limb. The stomach is supplied from the sixth, seventh, eighth, and ninth dorsal nerves, and the liver from the seventh, eighth, ninth, and tenth: and so it is not surprising that a patient whose stomach or liver is out of order complains of pain between the scapulæ or at the lower scapular angle, for the lower angle of the scapula corresponds to the seventh intercostal or interspinous space. It will be remembered that the kidneys, testes, and ovaries are all developed in close relation with the embryonic glandular structures called the Wolffian bodies, and so the kidney and ureter and the testicle are all supplied by the three lowest dorsal and first lumbar nerves. Thus, renal calculus may cause pain in the testis, and conversely, disease of the testis may cause pain in the lumbar region. Indeed Weir Mitchell refers to a case in the American war where a wound of the testicle caused pain in the back alone.<sup>1</sup> In renal colic pains may shoot down the inside of the thigh, for the skin here is supplied from the first lumbar nerve. The intestines, except the rectum, are supplied by the ninth, tenth, eleventh, and twelfth dorsal nerves, and so a pain in the back, higher than the lumbar pain of kidney disease and lower than the scapular pain of liver disorder, may be due to a loaded colon. The rectum, and the mucous membrane and neck of the bladder are supplied by the second, third, and fourth sacral nerves. From these same nerves the pudic nerve supplying the penis is derived, and so is explained the urethral pain induced by disease of the rectum or bladder. Lordat tells of a man who suffered from dysuria, and who, every time he wished to urinate, had to get upon his feet, separate his legs, and make tremendous efforts. Then when the bladder began to act there came into the soles of his

<sup>1</sup> *Op. cit.*, p. 234.



feet an intolerable pain which diminished in proportion as the urine was evacuated. Another case of Lordat's was a hemiplegic who had almost complete anæsthesia of the genitals. He had no direct consciousness of the passage of urine, and was only made aware of it by a feeling of cramp on the dorsum of the great toe.<sup>1</sup> The sole of the foot and the dorsa of the toes are both innervated from the first sacral nerve, which also contributes to the sensory supply of the prostate and sometimes of the mucous membrane and neck of the bladder.

The last, but not the least interesting of the pains I shall mention as belonging to this third group is the frontal headache of gastric disturbances. Perhaps not every one here is aware that pain in the forehead is sometimes caused by eating ices. In one carefully observed case which came under my notice, a portion of ice was swallowed rather quickly, and the cold mass caused severe pain in the stomach for some seconds; there was simultaneous severe pain at the root of the nose on the right side only, particularly in the angle between the nose and the supra-orbital margin. Dr. Lauder Brunton<sup>2</sup> has distinguished a pain in the upper part of the forehead which, in the absence of constipation, is relieved by alkalies, and a pain in the lower part of the forehead which under similar circumstances is relieved by acids. But this distinction is not always to be recognised. Sometimes pain in the lower part of the forehead is relieved by an acid, but sometimes the correct treatment is neutralisation of excessive acidity in the stomach by an alkali. I have met with a case in which the converse of Dr. Brunton's doctrine proved correct. A woman was treated for dyspepsia with an acid mixture. After she began to take this, troublesome pain set in at the lower part of the forehead, over the root of the nose. An alkaline mixture was thereupon substituted for the acid, and the pain went away. Now, no doubt the headache of stomachic and bilious disorders is often due to the effect upon the head of deleterious agents circulating in the blood, just as in the case of fevers at their onset. But often these headaches are referred neuralgiæ, and in such an instance as that quoted of pain caused by eating ices, no other explanation is possible. The forehead is in the territory of the fifth nerve, the principal nerve of ordinary sensation in the head, and as the stomach sends sensory impulses by way of the vagus to the brain, it has been suggested that the vagus

<sup>1</sup> Quoted by H. de Fromental, *Les Syngalgies et les Synesthésies* (Paris, 1888), p. 155.

<sup>2</sup> *Disorders of Digestion*, 1886, pp. 108, 109.

contains visceral sensory nerve fibres corresponding to somatic sensory fibres present in the fifth.

To a fourth group, which is but provisional, I would relegate all the miscellaneous, unclassified, and as yet unexplained sympathetic pains and other abnormal sensations with which we meet. A number of these centre round the bladder and urethra. The familiar shiver associated with micturition is perhaps a reflex motor phenomenon. A medical student who was at one time a patient of mine was over 20 before he suspected that it was not the usual thing to shed tears on evacuating the bladder—a reflex secretory phenomenon. Cases are recorded in which the act of micturition always caused pain in the region supplied by the ulnar nerve.<sup>1</sup> In some cases, after amputation of the thigh, both micturition and defæcation have caused severe pains in the stump.<sup>2</sup> In another case, the pain caused by an injection for gonorrhœa was felt as an acute pain on the top of the head.<sup>3</sup> Gowers mentions a case in which intense fronto-occipital pain was induced by every act of defæcation.<sup>4</sup> I have lately put on record<sup>5</sup> a case of angina pectoris the phenomena of which included pain in the left eyebrow and right upper limb and an intense desire to urinate; and Professor Osler, of Baltimore, tells me in a private letter that he has “recently had a case in which the trouble seemed to begin with an agonising attack of pain in one testis.”

Injuries to the limbs have sometimes caused distant sympathetic pains. A severe bruise of the first two toes of the *right* foot gave rise immediately to a pain in the left shin so sharp as actually to distract attention from the seat of injury. At the time of reporting, the referred pain had already for three weeks survived that of the part hurt.<sup>6</sup> A blow on a finger in which was a whitlow caused a lasting and very violent pain in the face and neck of the opposite side.<sup>7</sup> A shell-wound of the right leg gave rise at once to pain in both feet and in the right arm and right side of the chest.<sup>8</sup> Intense pain has been felt in the forehead when the sciatic nerve was divided in an amputation of the thigh without chloroform.<sup>9</sup>

<sup>1</sup> Gowers, *Diseases of the Nervous System*, second edition, vol. ii, p. 813.

<sup>2</sup> H. de Fromentel, *op. cit.*, p. 156.

<sup>3</sup> Weir Mitchell, *op. cit.*, p. 233.

<sup>4</sup> *Op. cit.*, p. 799, note.

<sup>5</sup> *Glasgow Medical Journal*, February, 1898, pp. 107, 108.

<sup>6</sup> Weir Mitchell, *op. cit.*, pp. 231-233.

<sup>7</sup> *Ibid.*, p. 233.

<sup>8</sup> *Ibid.*, p. 233.

<sup>9</sup> De Fromentel, *op. cit.*, p. 154.

As curious as these was a case which I recorded in detail in *Brain* some years ago.<sup>1</sup> The patient was a fireman, æt. 44, who, about a month after a slight accident involving the chest and arm of the right side, discovered when washing his arms that rubbing the back of the right fore-arm induced pain in the right side of the chest in front. A touch on the back of the limb in any part of a strip of surface extending from below the elbow to the four inner metacarpo-phalangeal articulations was felt both locally and in the area I have mentioned on the right front of the chest. Firm pressure on the part of the arm described caused no pain locally, but caused severe "tearing" pain in the chest front.<sup>2</sup> I have met with another case in which a man caused pain in his chest by washing his hands. Pressure at the front of the wrist, at the root of the thumb, or at the flexure of the elbow on the left side caused pain, not locally, but in the left lateral region of the chest. There was pain on pressure at this part of the chest owing to a slight pleurisy, but pain began at the elbow two weeks before the chest troubled him.

John K. Mitchell, in his important work on *Remote Consequences of Injuries of Nerves*, mentions several cases in which there was mis-reference of a touch in consequence of an old injury of a nerve. Almost always the touch was referred to a part of the limb proximal to the correct place. Much less common was a mis-reference distally. In one case both phenomena were present—a touch on one or other digit was referred, it might be, to another digit, to the wrist, or to the elbow, the mistakes with the different fingers being always the same on repeated trials; whilst a touch about the elbow was always referred to the hand.<sup>3</sup> In a girl of 13, three years after an injury to the spine by a fall, both touch and pain in the feet and legs, if felt at all, were referred to the head.<sup>4</sup> It has been suggested by way of explanation of such cases as depend upon nerve injuries, that possibly in the union of the severed nerve trunk, the axis cylinders in the proximal part do not always succeed in joining the proper axis cylinders in the distal portion. For instance, after a

<sup>1</sup> *Brain*, 1895, winter number, pp. 566-570, with plate.

<sup>2</sup> This case does not conform to the type of allochiria as described by Obersteiner, or of allachæsthesia as described by Grainger Stewart. At the same time, it has been found that in allochiria one particular form of sensation (touch, pain, temperature, tickling, or a special sense) may be alone involved. If the present case be an instance of allachæsthesia, pain is the form of sensation affected.

<sup>3</sup> J. K. Mitchell, *op. cit.*, p. 76.

<sup>4</sup> *Ibid.*, p. 132.



lesion of a nerve in the upper arm, nerve fibres in the proximal stump which normally convey sensation from the elbow region may unite with fibres in the distal piece of nerve which are anatomically connected with the hand. Thus the impression due to a touch on the hand will on reaching the seat of injury be shunted on to the path which has hitherto been that of impressions from the elbow, and so the person cannot help referring the touch on the hand to the elbow.<sup>1</sup> J. K. Mitchell says that false reference of touch is doubtless "incidental to a nerve's undergoing repair; that is, it is a natural part of the process of regeneration, and where the recovery was perfect this state would gradually pass away."<sup>2</sup> As some of his cases were due to lesions of twenty-five to thirty years' standing, we must suppose that in them improvement had ceased before complete repair was secured.

One more set of sympathetic sensations remains to be mentioned, as strange as any yet alluded to. A considerable treatise was published about them by Henry de Fromental in 1888.<sup>3</sup> For instance, a painful stimulation of the skin of the thigh may give rise to a pain at the back of the chest. De Fromental mentions a personal experience of his own that impressed him. He had an acne pustule over the sternum, rather to the left side, at the level of the nipples. He proceeded to evacuate it with the finger-nail, and in so doing caused a slight sharp pain locally, and almost immediately a dart of pain of far greater intensity in the left lumbar region, where the skin was quite sound. After a few moments he again attacked the pustule, when the same pain in the lumbar region of the same side was again called forth; and this happened over and over again until the pustule was completely removed. This experience he mentions as only one of many of the same kind that he had met with in himself and others. Such a sympathetic pain he calls a "synalgia," and he uses the word "synæsthesia" as a more general expression for sympathetic sensory phenomena of this type, whether painful or not.<sup>4</sup>

It is not only pain that may thus be experienced sympathetically. Two instances may be mentioned. A young man whom I attended some years ago for a chronic ailment found when his legs were shampooed that friction of the inner aspect of either leg sometimes caused a tickling sensation in

<sup>1</sup> W. H. Howell, quoted by J. K. Mitchell. *op. cit.*, pp. 238-240.

<sup>2</sup> *Op. cit.*, p. 68.

<sup>3</sup> *Les Synalgies et les Synæsthésies*, Paris, 1888.

<sup>4</sup> *Op. cit.*, p. 9.



the opposite side of the neck. Fromentel mentions a man who had a habit of scratching his head while reading. One day when he had scratched his head in his usual mechanical fashion, he was surprised to experience a tickling of his nostrils which culminated in a sneeze. He found that irritation of a particular point of his scalp was the cause, and having once accidentally discovered it, he continued from that time able to call forth a sneeze at will simply by scratching the appropriate point on his head.<sup>1</sup>

These synæsthesiæ are not yet of practical importance, but they should not be laughed at, for we do not know how soon they may, like the knee-jerk, be raised to the dignity of highly important factors in diagnosis. Only a few results of Fromentel's study of the subject will be mentioned here. (1) It would appear that in a given individual the relation between the irritated part and the sympathetic point is very constant; (2) whether the irritated point be on a limb, on the head, or on the trunk, the sympathetic point is generally on the trunk, and on the same side of the body; (3) the synæsthesiæ constitute phenomena of a cerebral or psychical order, and result from the action of one perceptive centre upon a neighbouring, intimately related, perceptive centre.<sup>2</sup>

Apart from these synæsthesiæ, it will be obvious from what has gone before that many sympathetic pains are of great use in diagnosis, and the more thorough the physician's acquaintance with the distribution of the cutaneous and visceral nerves, the better will he be able to utilise these pains in his study of cases. Is there anything to be added on the subject of treatment? To cure a sympathetic pain we must, of course, do what we can to remove its cause, but are we to employ treatment directed to the relief of pain in one part which depends, let us say, on incurable disease in an entirely different part? I think it is right to do this where it is practicable. We know that these sympathetic pains must in most instances, if not in all, be effective through the

<sup>1</sup> In the discussion which followed the reading of this paper, one gentleman said that pressure on a certain part of his leg frequently induced a pain or soreness in the left front of the chest. A second said that shampooing of his head invariably brought on sneezing. A third member of the Society said that in his case the eating of ices always caused severe pain in the forehead, lasting for about half an hour, and not associated with pain in the stomach; nothing but ices produced such pain.

For further instances of sympathetic pains, &c., see *Works of John Hunter*, edited by Palmer, 1835, vol. i, p. 321; De Fromentel, *op. cit.*, pp. 18, 155 *et passim*; Weir Mitchell, *op. cit.*, p. 234.

<sup>2</sup> De Fromentel, *op. cit.*, pp. 24, 40-48, 128.

activity of nerve centres: and it is probable that many are dependent, as Fromental considers the synæsthesiæ to be, upon moderately high—viz., upon cerebral—centres. This view is supported by the fact that a sympathetic pain may long survive the pain of the original lesion—a fact which shows pretty plainly that the centre through which the sympathetic pain is perceived may (in consequence of the disturbance produced in it by the influence of the other centre through which alone the pain ought to be felt) get seriously disordered in its nutrition, and require special treatment. The appropriate treatment will probably be both sedative and tonic, to counteract what old writers would have called the “irritable weakness” of the centre.



